

Dietary Fiber Is Beneficial for the Prevention of Cardiovascular Disease: An Umbrella Review of Meta-analyses

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ABSTRACT

Objective: The purpose of this study was to review previously published meta-analyses on the effectiveness of dietary fiber on cardiovascular disease.

Methods: An umbrella review of all published meta-analyses was performed. A PubMed search from January 1, 1980, to January 31, 2017, was conducted using the following search strategy: (fiber OR glucan OR psyllium OR fructans) AND (meta-analysis OR systematic review). Only English-language publications that provided quantitative statistical analysis on cardiovascular disease, lipid concentrations, or blood pressure were retrieved.

Results: Thirty-one meta-analyses were retrieved for inclusion in this umbrella review, and all meta-analyses comparing highest versus lowest dietary fiber intake reported statistically significant reductions in the relative risk (RR) of cardiovascular disease mortality (RR = 0.77-0.83), as well as the incidences of cardiovascular disease (RR = 0.72-0.91), coronary heart disease (RR = 0.76-0.93), and stroke (RR = 0.83-0.93). Meta-analyses on supplementation studies using β -glucan or psyllium fibers also reported statistically significant reductions in both total serum and low-density lipoprotein cholesterol concentrations.

Conclusion: This review suggests that individuals consuming the highest amounts of dietary fiber intake can significantly reduce their incidence and mortality from cardiovascular disease. Mechanistically, these beneficial effects may be due to dietary fibers' actions on reducing total serum and low-density lipoprotein cholesterol concentrations between 9.3 to 14.7 mg/dL and 10.8 to 13.5 mg/dL, respectively. (*J Chiropr Med* 2017;xx:1-11)

Key Indexing Terms: *Dietary Fiber; Meta-analysis; Cardiovascular Diseases; Coronary Heart Disease; Stroke; Cholesterol; Blood Pressure*

INTRODUCTION

In the United States, at least 21% of adults have undesirably high serum cholesterol concentrations of >240 mg/dL, and 28% have hypertension.¹⁻³ Both hypercholesterolemia and hypertension are contributing factors in the development of coronary heart disease and stroke, which together contribute to 38% of all deaths caused by cardiovascular disease in the United States.⁴⁻⁶ Dietary fiber intake has repeatedly been reported to be beneficial in reducing both serum cholesterol and blood pressure, and so it is believed that a deficiency in dietary fiber might be contributing to the epidemic of cardiovascular disease.⁷

Dietary fibers are the edible parts of plants that are resistant to digestion and absorption in the human small intestine, and when comparing persons with the highest dietary fiber intakes with those with the lowest, the relative risk of total all-cause mortality dropped by 16% to 23%.⁸⁻¹⁰

Many past clinical trials investigating dietary fiber intake on cardiovascular disease risk have reported protective benefits,¹¹⁻¹⁴ but not all of these trials are in agreement.¹⁵⁻¹⁸ Many of the clinical trials conducted to study the effects of dietary fiber intake on cardiovascular disease may have had sample sizes that did not provide sufficient statistical power to detect small potentially meaningful changes in effect.¹⁹ Given the inconsistency of the existing literature and the insufficient statistical power as a result of small sample sizes, a pooling of information from individual trials could provide a more precise and accurate estimate of dietary fibers' role in ameliorating cardiovascular disease. To achieve this result, many investigators have turned to performing a powerful statistical method known as meta-analysis. Meta-analyses are fundamental to provide the highest level of evidence to best inform health care decision making. Therefore, the purpose and objective of this paper is to summarize the evidence from previously published meta-analyses regarding the effectiveness of the role of dietary fiber as a therapeutic agent for cardiovascular disease.

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METHODS

An umbrella review was selected for this study. An umbrella review provides a summary of existing published meta-analyses and systematic reviews and determines whether authors addressing similar review questions independently report similar results and arrive at similar conclusions.²⁰

Because meta-analyses started appearing in the medical literature in the early 1980s, a systematic literature search of PubMed and CINAHL from January 1, 1980, to January 31, 2017, was conducted using the following search strategy: “(fiber OR fibre OR chitosan OR fructan OR glucan OR gums OR inulin OR lignin OR pectin OR psyllium OR bran) AND (meta-analysis OR systematic review).” The titles and abstracts from the literature search were scanned, and only English-language publications that provided quantitative statistical analysis on cardiovascular disease, coronary heart disease, stroke, serum lipids, cholesterol, and blood pressure were retrieved. Meta-analyses or systematic reviews that did not present study-specific summary data using a minimum of 4 randomized controlled trials were excluded.

For the published meta-analyses that were accepted into this review, the following information was extracted and entered into an Excel spreadsheet: number of publications included in the meta-analysis, number of total participants, fiber type and daily dose, pooled treatment effects for clinical endpoints (such as total cholesterol or systolic blood pressure),

and/or summary relative risks (RRs). Although not always present, the meta-analyses were also analyzed for their disclosure of quality assessment, statistical heterogeneity (Cochrane Q test and I^2 statistic), and publication bias (visual inspection of funnel plots and Egger or Begg regression test). A methodological quality appraisal was conducted for all meta-analyses using the Critical Appraisal Checklist for Systematic Reviews, which was developed by the Umbrella Review Methodology Working Group.²⁰ This checklist consists of 10 items; each item within the instrument can receive 1 point, for an overall quality score that could range from 0 to 10. Meta-analyses with quality scores ranging from 0 to 4 were labeled as low quality, those with scores between 5 and 7 as medium quality, and those with scores of 8 to 10 as high quality. Because this is a descriptive summary review of meta-analyses, no statistical analyses were performed.

RESULTS

The initial search strategy identified 516 articles, and after careful review 31 meta-analyses were retrieved for inclusion into this umbrella review.²¹⁻⁵¹ One meta-analysis was excluded because it was not published in English; this meta-analysis investigated the effects of fructans on blood lipid profiles.⁵² A flow chart of the meta-analyses selection process is provided in Figure 1.

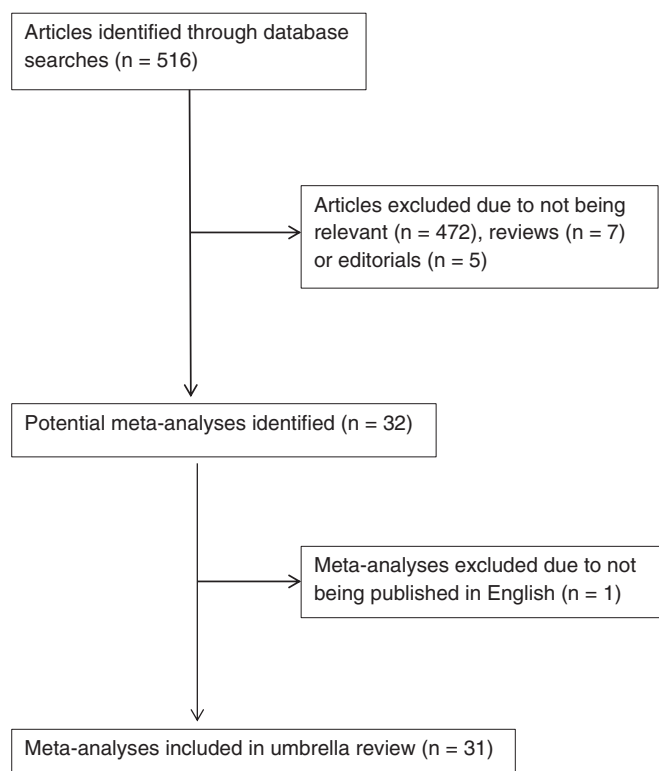


Fig 1. Flow chart of meta-analysis selection.

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